

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

Claim 1 (canceled).

2. (Currently Amended) A belt transmission apparatus, comprising:

a rotating electric machine pulley of a rotating electric machine for transmitting starting power to an engine;

an engine pulley for transmitting the starting power to said engine and also transmitting a rotation power of said engine to an accessory;

an auxiliary pulley being driven to rotate by the power from said engine pulley thereby to drive said accessory;

a belt wrapped around said rotating electric machine pulley, said engine pulley and said auxiliary pulley in succession; and

a belt tension adjuster for urging said belt so as to set a tension of said belt in a plurality of stages, wherein:

said tension adjuster acts to adjust the tension of the belt in such a manner that the belt tension is set to be greater when said engine is started by said rotating electric machine than when said accessory is driven to operate after said engine has been started;

after said engine has been started, the set tension is switched or changed by said tension adjuster to an ordinary tension of said belt suitable when said accessory is driven; and

said tension adjuster is disposed in an area in which a slack of said belt occurring when said engine is started by said rotating electric machine becomes the greatest.

3. (Cancelled)

4. (Previously Presented) A belt transmission apparatus, comprising:

a rotating electric machine pulley of a rotating electric machine for transmitting starting power to an engine;

an engine pulley for transmitting the starting power to said engine and also transmitting a rotation power of said engine to an accessory;

an auxiliary pulley being driven to rotate by the power from said engine pulley thereby to drive said accessory;

a belt wrapped around said rotating electric machine pulley, said engine pulley and said auxiliary pulley in succession; and

a belt tension adjuster for urging said belt so as to set a tension of said belt in a plurality of stages,

wherein said tension adjuster acts to adjust the tension of the belt in such a manner that the belt tension is set to be greater when said engine is started by said rotating electric machine than when said accessory is driven to operate after said engine has been started.

wherein said tension adjuster comprises: a pulley unit around which said belt is wrapped whereby to rotate in accordance with movement of said belt; and an automatic belt tensioner for urging said pulley unit to push said belt through said pulley unit, and

wherein said automatic belt tensioner comprises:

a first housing with first and second axial end walls;

an elastically deformable spring;

a push rod extending through the first axial end wall, for urging said pulley unit with a reactive force generated upon elastic deformation of said spring, comprising a planar disk portion having an outer diameter equivalent to an inner diameter of the housing; and

an elastic deformation unit, for elastically deforming said spring, comprising a planar disk portion having an outer diameter equivalent to an inner diameter of the housing;

wherein the elastically deformable spring is arranged between said disk portion of said piston and said disk portion of said push rod.

5. (Previously Presented) The belt transmission apparatus according to claim 4, wherein said elastic deformation unit further comprises:

an electromagnetic coil; and

a movable electromagnetic core, including said planar disk portion, adapted to be attracted by an electromagnetic attraction force developed upon energization of said electromagnetic coil thereby to push said spring.

6. (Previously Presented) The belt transmission apparatus according to claim 4, wherein said elastic deformation unit further comprises:

a piston including said planar disk portion;

a control unit comprising an electromagnetic coil and a spool adapted to be moved by an electromagnetic attraction force developed upon energization of said electromagnetic coil, wherein:

the housing is cylindrical and comprises a fluid chamber into which pressure fluid is caused to flow in accordance with movement of said spool; and

the piston is adapted to be moved to push said spring in accordance with an increasing pressure in said fluid chamber.

7. (Previously Presented) The belt transmission apparatus according to claim 4, wherein said elastic deformation unit further comprises:

a wax housing having a diaphragm chamber defined therein by a diaphragm and filled with a wax;

a heater unit mounted on said wax housing and adapted to generate heat when energized; and

a piston, including said planar disk portion, adapted to push said spring in accordance with an expansion of said wax heated by the heat generated by said heater unit.

8. (Previously Presented) The belt transmission apparatus according to claim 4, wherein said elastic deformation unit further comprises:

- an electric motor;
- a screw type position adjustment shaft adapted to be rotated by torque of said electric motor transmitted thereto; and
- a screw type movable disk, including said planar disk portion, adapted to be moved in an axial direction to push said spring in accordance with rotation of said screw type position adjustment shaft.

9. (Previously Presented) The belt transmission apparatus according to claim 4, wherein said housing is filled with a viscous fluid.

10. (Cancelled)

11. (Currently Amended) A belt transmission apparatus, comprising:

- a rotating electric machine pulley of a rotating electric machine for transmitting starting power to an engine;
- an engine pulley for transmitting the starting power to said engine and also transmitting a rotation power of said engine to an accessory;
- an auxiliary pulley being driven to rotate by the power from said engine pulley thereby to drive said accessory;

a belt wrapped around said rotating electric machine pulley, said engine pulley and said auxiliary pulley in succession; and

a belt tension adjuster for urging said belt so as to set a tension of said belt in a plurality of stages, wherein:

said tension adjuster acts to adjust the tension of the belt in such a manner that the belt tension is set to be greater when said engine is started by said rotating electric machine than when said accessory is driven to operate after said engine has been started;

said engine comprises a vehicular engine; and

the position of said ~~push-rod~~ tension adjuster is set by a signal from a central processing unit which processes information comprising, at least, an rpm of said engine, an engine starting signal, a vehicle speed, and the tension of said belt.

12. (Previously Presented) The belt transmission apparatus according to claim 2, wherein said rotating electric machine comprises a starter motor.

13. (Previously Presented) The belt transmission apparatus according to claim 2, wherein said rotating electric machine comprises a motor generator.

14. (Cancelled)

15. (Previously Presented) The belt transmission apparatus according to claim 16, wherein said pulley unit is movable rotatably around an axis offset from said rotatable connection between said tension pulley and said pulley unit, and said tension pulley and said pulley unit rotate in planes generally parallel to each other.

16. (Previously Presented) A belt transmission apparatus, comprising:
an electric machine pulley rotatably connected to a rotating electric machine;
an engine pulley rotatably connected to a crankshaft of said engine;
an auxiliary pulley rotatably mounted to an accessory;
a tension pulley rotatably connected to a pulley unit,
an automatic belt tensioner connected to said pulley unit;
a belt wrapped around said electric machine pulley, said engine pulley, said auxiliary pulley and said tension pulley; wherein:
said belt transmits starting power from said rotating electric machine to said engine, and transmits rotation power of said engine to said accessory;
said pulley unit is movably connected to said engine;
said automatic belt tensioner urges the movement of said pulley unit based upon an operational condition of the engine, thereby setting a tension in said belt that is greater when said engine is started by said rotating electric machine than when said engine is running and said belt is transmitting rotation power to said accessory, and
said automatic belt tensioner comprises:

a first cylindrical housing with first and second axial end walls;

a piston, which is axially movable within said cylindrical housing, comprising a planar disk portion having an outer diameter equivalent to an inner diameter of the cylindrical housing;

a push rod, which is axially movable within said cylindrical housing and extends through one of said axial end walls to contact said pulley unit, comprising a planar disk portion having an outer diameter equivalent to an inner diameter of the cylindrical housing;

a first elastically deformable spring arranged between said disk portion of said piston and said disk portion of said push rod; and

a control unit that axially moves said piston.

17. (Previously Presented) The belt transmission apparatus according to claim 16, wherein said control unit comprises:

a second cylindrical housing;

an electromagnetic coil;

a spool axially movable within said cylindrical housing and shaped to form fluid chambers in conjunction with said cylindrical housing;

a second elastically deformable spring arranged between said electromagnetic coil and said spool; wherein

said spool is axially movable to a first position by an electromagnetic attraction force developed upon energization of said electromagnetic coil;

when said spool is moved to said first position, a flow of pressurized fluid is allowed to pass through said control unit and into a pressure oil chamber of said automatic belt tensioner defined by said first cylindrical housing and said piston to thereby axially move said piston and said push rod toward said pulley unit, and raise the tension in said belt.

18. (Previously Presented) The belt transmission apparatus according to claim 17, wherein said spool is axially movable to a second position by said second elastically deformable spring upon de-energization of said electromagnetic coil;

said second position allowing the flow of fluid from said pressure oil chamber to a holding tank to thereby allow the axial movement of said piston and said push rod away from said pulley unit, and lower the tension in said belt.

19. (Previously Presented) The belt transmission apparatus according to claim 2, further comprising a tension pulley rotatably connected to a pulley unit, wherein said pulley unit is movably connected to said engine between said tension adjuster and said belt, and said tension adjuster urges the movement of said pulley unit to adjust the tension of said belt.

20. (Previously Presented) The belt transmission apparatus according to claim 19, wherein said pulley unit is movable rotatably around an axis offset from said rotatable connection between said tension pulley and said pulley unit, and said tension pulley and said pulley unit rotate in planes generally parallel to each other.

21. (Previously Presented) The belt transmission apparatus according to claim 16,
wherein:

said piston further comprises a rod portion extending orthogonally from the center of said
disk portion of said piston towards said push rod;

said push rod further comprises a cylindrical portion extending orthogonally from the
center of said disk portion of said push rod towards said piston; and

said cylindrical portion of said push rod is hollow and said rod portion of said piston
extends therein.

22. (Previously Presented) The belt transmission apparatus according to claim 21,
wherein said first elastically deformable spring is a coil spring arranged so that it surrounds said
cylindrical portion of said push rod and said rod portion of said piston.

23. (Previously Presented) The belt transmission apparatus according to claim 16,
wherein the first axial end wall of the cylindrical housing comprises:

a cover housing secured to an end face of the cylindrical housing near the push rod in a
fluid tight manner comprising a push rod hole axially centered therein; and

a slide bearing and seal fitted in an axially inner side of the push rod hole to interface
with the push rod.

24. (Previously Presented) The belt transmission apparatus according to claim 23,
wherein
a supply and discharge port for pressure oil is formed through the second axial end wall
near the piston,
and a drain port is formed through a side surface of the cylindrical housing near the
cover housing.

25. (Previously Presented) The belt transmission apparatus according to claim 16,
wherein said disk portion of said piston and said disk portion of said push rod have the same
diameter.

26. (Previously Presented) The belt transmission apparatus according to claim 16,
wherein the first cylindrical housing is fluid-tight.

27. (Previously Presented) The belt transmission apparatus according to claim 17,
wherein:
the spool comprises an axially extending rod and a plurality of radially extending lands
having outer diameters equal to an inner diameter of the second cylindrical housing;
the rod of the spool extends into the electromagnetic coil;
the radially extending lands open inflow and outflow ports arranged on lateral sides of the
second cylindrical housing.

28. (Previously Presented) An automatic belt tensioner for use in an engine belt transmission apparatus, comprising:

- a first cylindrical housing with first and second axial end walls;
- a piston, which is axially movable within said cylindrical housing, comprising a planar disk portion having an outer diameter equivalent to an inner diameter of the cylindrical housing;
- a push rod, which is axially movable within said cylindrical housing and extends through one of said axial end walls to contact a tensioner to tension a belt on the vehicular engine, comprising a planar disk portion having an outer diameter equivalent to an inner diameter of the cylindrical housing;
- a first elastically deformable spring arranged between said disk portion of said piston and said disk portion of said push rod; and
- a control unit that axially moves said piston.